Section 6: Planning

Introduction – What is planning?

Encompassing many aspects of civil design and construction, "planning" means making informed decisions based on a complete knowledge base, taking into account past and future models of development and societal trends.

In the case of a Comprehensive Plan, a "complete knowledge base" will include both objective information (maps and population/demographic data) and subjective information (public opinion surveys and responses at town meetings). Town planners and local citizens alike will find the GIS-type system both functional in terms of a communication device, and appealing in terms of a human-to-computer interface.

A Comprehensive Plan will serve two groups in the community, "leaders and residents". It will be used as a "guiding light" for planners and town leaders to "stay the course" in their efforts to better the community and the town in which they themselves live. The Plan will offer a resource to look back upon, and a base on which many future decisions will be formed. For the "livers", or the residents of the jurisdiction, the Plan will keep them abreast of community plans and long-term values and objectives their leaders have set for the area. It will allow them to form opinions on design trends and future zoning patterns, and most importantly, to communicate their opinions and wishes to their decision makers in an efficient and organized fashion.

Other areas of municipal management have applications in GIS as well. The zoning/rezoning process can be computerized with GIS, allowing citizens and planners alike to access zoning variance submissions and zoning ordinances. Municipal planners would be well served to have access to historical structure (and historical area) data. Historical structures cannot be cleared to make room for new development, so other provisions would have to be made. To have this data incorporated into a GIS would be a large help to the planning process.

Transportation planning and maintenance is an industry of its own, but this data, too, can be integrated into a GIS; it can be either *Inter*- or *intra*net based. Planning for construction of a road or other transportation system requires a vast amount of spatial data, including existing roads, topography (contour lines), hydrology (creeks and rivers), existing tax parcels, and existing structure footprints. Other data (like drainage features and zoning maps) may prove to be extremely helpful in the process of planning a new road alignment. All this data can be hosted and served by a GIS; this centralizes all data, making the process of data access extremely efficient.

A) Wireless Communication Existing & Proposed Tower Site Analysis

1) Spatial Data
   a) Minimum Requirements
      - Existing & proposed tower site locations (point data)
      - Roads (either center lines or edges of pavement)
      - Tax parcel mapping
   b) Optional Requirements
      - Digital orthophotography
      - Topographic data (2 foot contours)
      - Building footprints
      - Hydrology (water features)
      - Zoning maps
      - Drainage features
      - Population density information
      - Point data
         - ⇒ Religious structures
         - ⇒ Recreation locations
         - ⇒ Historic landmarks
      - Ancillary line maps
         - ⇒ Sidewalks
         - ⇒ Nature paths
         - ⇒ Power lines
      - Municipal district overlays
         - ⇒ Police
         - ⇒ Fire

2) Attribute Data
   a) Tower site locations
      - Minimum Requirements
         - ⇒ Unique identifier
      - Optional Requirements
         - ⇒ Owner name (company, etc.)
         - ⇒ Owner address
         - ⇒ Height
         - ⇒ Material
         - ⇒ Year built
         - ⇒ Cost/value
         - ⇒ Congestion/usage figures
   b) Road maps
      - Minimum Requirements
         - ⇒ Road information
            - (i) Road type (private or public)
            - (ii) Route number or road name (whichever is applicable)
      - Optional Requirements
         - ⇒ Year built
         - ⇒ Traffic information
            - (i) Number of lanes in each direction
            - (ii) Cars/minute capacity (maximum traffic load capacity)
            - (iii) Current number of cars/minute (current traffic load)
   c) Tax Parcel Maps
      - Minimum Requirements
         - ⇒ Unique parcel identifier (tax map number, GPIN, etc.)

- ⇒ Zone type
- Optional Requirements
  - ⇒ Owner name
  - ⇒ Owner address
  - ⇒ Property address
  - ⇒ Deed Book/Page
  - ⇒ Plat Book/Page
  - ⇒ Land value
  - ⇒ Structure value
  - ⇒ Total value
  - ⇒ Age of structure(s)
  - ⇒ Acreage
  - ⇒ Date last assessed
  - ⇒ Date last surveyed

d) Topographic data (2 foot contours)
- Elevation
- Units (if not otherwise labeled)

e) Building footprints
- Owner name
- Owner address
- Building address
- Building type
- Building use (agricultural, residential, etc.)
- Building population (if residential)
- Year built
- Assessed value
- Date last assessed

f) Zoning maps
- Minimum Requirements
  - ⇒ Zone type
- Optional Requirements
  - ⇒ Number of parcels included
  - ⇒ Date last zoned
  - ⇒ Age of structure(s)

g) Point Data
- Minimum Requirements
  - ⇒ Name of point
  - ⇒ Type of point (school, church, etc.)
- Optional Requirements
  - ⇒ Owner name
  - ⇒ Owner address
  - ⇒ Property address
  - ⇒ Deed Book/Page
  - ⇒ Plat Book/Page
  - ⇒ Land value
  - ⇒ Structure value
  - ⇒ Total value
  - ⇒ Age of structure(s)
  - ⇒ Acreage
  - ⇒ Date last assessed
  - ⇒ Date last surveyed

h) Ancillary Line Maps
- Minimum Requirements

- ⇒ Name of line
- ⇒ Type of line (sidewalk, water line, etc.)

- Optional Requirements
  - ⇒ Owner name
  - ⇒ Owner address
  - ⇒ Ownership (private or public)
  - ⇒ Length of line
  - ⇒ Width of line
  - ⇒ Material of line (PVC, cement, etc.)

i) Municipal District Overlays

- Minimum Requirements
  - ⇒ District name
  - ⇒ District type (police, fire, etc.)
- Optional Requirements
  - ⇒ Population served
  - ⇒ Maximum population capacity

3) Data Acquisition Options

a) Road mapping

- Acquire from Virginia Department of Transportation (limited availability) or from a third party vendor
- Digitize in-house from aerial photography

b) Contour Lines

- USGS, US Forest Service, National Park Service, etc.

c) Tower Information

- Local telephone company
- Cellular telephone company with service in the area

d) Tax mapping

- In-house
  - ⇒ Scan hardcopy tax maps and geo-reference them, according to the coordinate system chosen
  - ⇒ On-screen (heads-up) digitization of parcel boundaries relative to tax maps
    (i) Quick, but less accurate than using Coordinate Geometry (CoGo)
  - ⇒ Entering each parcel boundary into CAD/GIS software using deed books and property descriptions
    (i) Extremely accurate, but time-consuming and expensive
  - ⇒ More information can be found in the Finance/Tax Mapping section
- Contract with third party vendor for digitization work

e) Zone mapping

- Planning department
- Hardcopy tax maps

f) Orthophotography sources

- VGIN's VBMP imagery
- USGS orthophotography (DOQs)
- Aerial photography from a third party vendor

4) Data Conflation Options

a) Orthophotography

- Verify that all digital orthophotography image chips to cover the county or interest area are accessible (if applicable).
- Use CAD/GIS software to mosaic all image chips into one complete image, for ease of use.

b) Tax Parcel Mapping

- Conflate the tax parcel boundary data to the orthophotography, using the imagery as a reference rather than as a determiner of absolute property location. A real

estate database can be used to check property addresses against existing E-911 street address mapping. Maintain relative parcel size, geometry, and orientation within a section map.

c) Zone Mapping
- Conflate zone mapping to the orthophotography, again, using the imagery as a reference rather than as a determiner of absolute zone location.

d) Point/Line Data
- Manually conflate the point and/or line data to the digital orthophotography, including school locations, hospital locations, etc.

5) GUI/Programming Options
a) Custom searches and queries to locate towers based on certain criteria (height, owner, etc.).

6) Internet Functionality and Options
a) From an Internet standpoint, all mapping information (both required and optional, if applicable) could be integrated into one GIS-type interface.
b) All included spatial data might be integrated into one system consisting of a "base map" (contour lines perhaps) and a number of "overlays" to include existing tower locations, proposed tower locations, road center lines, creeks and streams, etc. These will all be helpful in making an informed decision about a proposed road alignment.

7) Technical Requirements
a) Minimum Requirements
- 400-MHz
- 2-GB hard drive
- 256-MB RAM
- 15" monitor
- CAD/GIS software
- Scanner (if electing to digitize in-house)
- Internet connection (for downloading data, if applicable)

b) Optional Requirements
- A faster machine will make work quicker; listed above is absolute minimum
- 850-MHz or above recommended
- 20-GB hard drive for increased storage space
- 512-MB RAM for faster regeneration and manipulation of data
- 17" or 19" monitor for increased screen resolution (and larger viewing area)

8) Administrative/Management Requirements
a) During development
- Public meetings
- Complete inventory
- Plan development
- Plan acceptance

b) After deployment
- Implementation
- Made available online or hardcopy

9) Cost – Cost/Benefit
a) In-house
- GIS technician - $8-$14 per hour
- Project manager - $16-$20 per hour
- Note: in-house costs do not include benefits and overhead

b) Contracted
- GIS technician - $30-$50 per hour
- Project manager - $55-$70 per hour

c) Schedule:
- Per section 12, estimate *approximately* 10-15 hours for preparation of each map. Each map will correspond to a data layer in the completed system; more data layers means more information is available to the user, but more cost is associated with it as well.

d) Benefits of a GIS
- A GIS provides a powerful, logical, and intuitive means to store, manipulate, and retrieve data.
- It can maintain, analyze, and report on geographic data such as points and symbols, lines and curves or polygons, and attribute data such as characters, numbers, and dates.
- A GIS provides the ability to see on screen or in map form, only those features or objects that meet specific selection criteria.
- In an instant, you can visually identify features in a geographic representation that would take much longer to find (and modify if needed) in a printed report.

10) Standards/Guidelines Summary

a) Spatial data
- Geographic data you want to see, such as road maps, zoning maps, land use maps, tax parcel maps, buildings and structures, etc.

b) Attribute data
- Database information behind the visual data. Includes real estate database information, linked to tax and zoning maps and other attribute data for other forms of spatial data.

c) Data acquisition
- Where and who you will get your data from.
- Most data is available from other governmental or municipal agencies, like Commissioner of Revenue's Office, Virginia Department of Transportation, etc.

d) Data conflation options
- Geometrically match your new data to your existing data.
- Establish a "base map" for your system (digital orthophotography for example) and correct all other maps to coincide with the aerial photos.

e) GUI/programming options
- How you can work with your data; includes custom database interfaces, possible Internet interfaces, review/revision provisions, etc.

f) Internet functionality options
- How you can put your data on the Internet (and its uses thereafter).
- Examine current examples on the Internet.
- Conduct public opinion surveys to discover what your citizens would like to see in your online system.
- Items listed here are merely examples.

g) Technical requirements
- What you will need to acquire, manipulate, and store your data.
- Listed here are the absolute minimums. Faster machines will increase efficiency.
- In this case, "the faster the better."

h) Administrative requirements
- Administration processes before and after system development.
- Listed (but not limited to) are tasks involved with setting up your system; includes working with other agencies, working with the public, advertising your system, and other tasks.

i) Cost – cost/benefit
- Costs associated with this work, and benefits of them.
- Pay rates of your in-house employees are lower than paying a vendor's employee time, but these rates do not include your jurisdiction's benefits package nor your overhead costs (for utilities, computer equipment, etc.).

11) Startup Procedures/Steps
    a) Digitization
        - On-screen (heads-up) digitization:
            ⇒ Scan each hardcopy map.
            ⇒ Digitize any and all boundary lines in CAD/GIS software.
        - If Coordinate Geometry (CoGo) information is available for a site or area:
            ⇒ Enter boundary lines into CAD/GIS software using Coordinate Geometry (CoGo) and property descriptions.
    b) Annotation
        - Using hardcopy maps or other information source, annotate all areas with the attributes desired (name, type of region, etc.).
        - Keep text insertion points in the centers of polygons, for ease of reading and for ease of database creation and linking after the data is ready.
    c) Conflation
        - Verify that all digital orthophotography image chips to cover the county or interest area are accessible.
        - Use CAD/GIS software to mosaic all image chips into one complete image, for ease of use.
        - Conflate the region boundary lines to the orthophotography, using the imagery as a reference for location of boundary lines of each area or region.
        - Maintain relative size, geometry, and orientation of said area when conflating to orthophotography.
12) Estimated Time Line and/or Implementation Schedule
    a) If maps need to be converted to digital:
        - Scanning (10 minutes) per sheet
        - Digitization (3 hours) per sheet
        - Annotation (1 hours) per sheet
        - Conflation (8 hours) per sheet
        - Approximately 12 to 13 man-hours are needed to accomplish the above tasks for each map. This is based on a moderately populated area. Variations in population density or types of maps can shorten or lengthen the time needed to complete all data for a single map.
    b) If maps are already digital:
        - Other forms of map data (point items, line items, etc.) should be manually conflated to existing digital maps and/or digital orthophotography images as applicable.
        - Time estimates for this work will vary widely with number of items to conflate, the size of the jurisdiction, etc.
13) Best Practice Examples in Virginia
    a) Virginia Tech University has a software package called GETWEBS (Geographic Engineering Tool for Wireless: Evolution of Broadband Systems). The abstract is available online at: http://www.fastlane.nsf.gov/servlet/showaward?award=9979364.
    b) GETWEBS is used to analyze an area for wireless communication tower placement and uses much of the same spatial and attribute data that a GIS uses, so integration is a natural extension of the original GETWEBS scope.